State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

June 9, 2011

Board of Land
and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to Dr. Carl Meyer, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Top Predator Feeding Habits and Movement Research Activities

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to Carl Meyer, assistant researcher, Hawaii Institute of Marine Biology, pursuant to § 187A-6, Hawaii Revised Statutes (HRS), chapter13-60.5, Hawaii Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa Island
- Necker Island
- French Frigate Shoals
- Gardner Pinnacles
- Maro Reef
- Laysan Island
- Lisianski Island
- Pearl and Hermes Atoll
- Kure Atoll

The activities covered under this permit would occur between May 1, 2011 and October 31, 2011.

The proposed activities are largely a renewal of work previously permitted and conducted in the Monument. New activities in this application include the collection of common reef fishes, algae and phytoplankton for isotopic analyses to determine feeding structure.

INTENDED ACTIVITIES

The Applicant proposes to equip top predators (sharks and large fishes) with electronic tags, and monitor their movements using acoustic receivers (deployed on the sea floor) and satellites; collect small, non-lethal tissue samples from top predators for chemical analysis to determine feeding habits; collect reference isotopic samples from deep and shallow reefs by: 1) lethal sampling of 120 reef fishes and 2) sampling benthic algae and phytoplankton. The purpose of the applicant's research is to provide Monument managers with information on the movement patterns and feeding habitats of culturally and ecologically important top predators in the Monument. This would include data on shark movement patterns and diet at French Frigate Shoals, which would lead to a better understanding of shark predation on Hawaiian monk seals and selecting appropriate management and mitigation strategies.

The research project has the following specific goals and objectives;

1. Download 48 underwater receivers currently stationed in the Monument to retrieve stored movement data from 240 top predators tagged with acoustic transmitters from 2008 to 2010.

2. Determine how widely these animals have ranged since August 2010 and identify their patterns of movement. Particular emphasis will be placed on determining the frequency and timing of visits by Galapagos and tiger sharks to monk seal pupping sites at FFS atoll.

3. Extend receiver coverage to mesophotic habitat by deploying 4 additional underwater receivers at FFS (2) and PHR (2).

4. Equip up to 80 additional ulua and Galapagos sharks (20 of each species at FFS and PHR) with pressure-sensor acoustic transmitters detectable by the listening array. These tag deployments would enable the Applicant to obtain the first insights into 'upslope-downslope' movements between shallow and mesophotic habitats by abundant monument predators.

5. Enhance the overall understanding of predator spatial dynamics at FFS by quantifying the movements of four abundant shark species (sandbar, reef whitetip, grey reef, blacktip) and three teleosts (amberjack, blue trevally, and kawa kawa) for which the scientific community currently lacks movement data. The proposed project aims to equip up to 20 individuals of each species with acoustic transmitters. This would take advantage of the listening array already in situ at FFS, and allow for simultaneous comparison with movement patterns of tiger (N=39) and Galapagos sharks (N=68) tagged at FFS in 2009.

6. Deploy tri-axial accelerometer + digital camera data loggers on up to 5 ulua and 5 Galapagos or tiger sharks at FFS to provide high resolution information on swimming patterns and habitat use.

7. Collect small samples of muscle tissue from predators (uluas and galapagos sharks) for chemical analyses (stable isotopes), from FFS and P&H to provide insight into predator feeding habits (40 samples per atoll). A small, non-lethal biopsy would be taken from each predator during tagging activities. To establish the chemical composition of prey species, tissue samples would be collected from 120 reef fishes collected at shallow and deep locations at FFS and PHR. To determine baseline stable isotope signatures, the Applicant would also collect samples of benthic algae (800g) and phytoplankton (800g) from FFS and P&H.

Tagging sharks and fish with acoustic transmitters, as well as downloading receives, are renewal activities for the Applicant. Methodologies remain the same as previous years. Predator handling & tagging activities would be carried out in accordance with the animal use protocols of the University of Hawaii (protocol #05-053).

The activities proposed by the Applicant directly support the Monument Management Plan's priority management needs 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science) and 3.2 – Conserving Wildlife and Habitats (through action plan 3.2.1 – Threatened and Endangered Species).

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving monument resource
- ☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☒ Attracting any living Monument resource
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since March 10th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

**Comments received from the scientific community are summarized as follows:**

Scientific reviews support the acceptance of this application.

The following concerns were raised. Applicant responses are noted below.

1. How is predation on hooked animals by sharks and other species prevented/mitigated?

The Applicant details that predation on hooked animals is mitigated by using short soak times (1-3h) on bottom set lines. The Applicant has had no instances of predation on hooked animals captured on handlines (while trolling or fishing single baited hooks).

2. The applicant wishes to deploy accelerometer-digital camera data loggers on 5 ulua and 5 Galapagos sharks at French Frigate Shoals. Do the cable ties, which remain attached to the animals after the recording device is released, pose an impediment to movement or an entanglement hazard?

The Applicant describes that the cable ties are small relative to the size of the instrumented predators and do not pose an entanglement hazard or impediment to swimming. The Applicant further explains that "the miniature explosive link can be seen close to the head of the cable tie. At time of release this breaks the cable tie at this point. Based on captive experiments, these broken cable ties are unlikely to be retained for more than a few days."

3. How does this work fit with the work proposed by NMFS to monitor for sharks at FFS? Do these two projects overlap? Or come to different conclusions?

The Applicant's research provides empirical answers to long-standing question about the number and type of sharks which visit monk seal pupping sites and may be contributing to pup predation. The subsequent data inform NMFS management actions.

**Comments received from the Native Hawaiian community are summarized as follows:**

Cultural reviews support the acceptance of this application.

**Comments received from the public are summarized as follows:**

No comments were received from the public on this application.

**Additional reviews and permit history:**

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g. MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- The proposed activities are in compliance with the National Environmental Policy Act.
- The Department has made an exemption determination for this permit in accordance chapter 343, HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR

PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CARL MEYER, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS TO CONDUCT TOP PREDATOR FEEDING HABITS AND MOVEMENT RESEARCH ACTIVITIES UNDER PERMIT PMNM-2011-018")

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐
If so, please summarize past permits:

- The applicant was granted permits DLNR/NWHI/06R003, PMNM-2007-031, PMNM-2008-027, PMNM-2009-036, and PMNM-2010-019 to conduct similar work in 2006 through 2010.

Have there been any a) violations: Yes ☐ No ☒
b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

STAFF OPINION:

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION:

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by DAR staff.

RECOMMENDATION:

Based on the attached proposed declaration of exemption prepared by the department after consultation with and advice of those having jurisdiction and expertise for the proposed permit actions:

1. That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

2. Upon the finding and adoption of the department's analysis by the Board, that the Board delegate and authorize the Chairperson to sign the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200, HAR.

3. That the Board authorize and approve a Research Permit to Dr. Carl Meyer, Hawaii Institute of Marine Biology, with the following special conditions:

a. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.

b. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.

c. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocol attached to this permit.

d. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.

e. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge.

Respectfully submitted,

Francis Oishi

for Administrator

APPROVED FOR SUBMITTAL

William J. Aila, Jr.
Chairperson

# Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

**NOTE:** ***This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

**ADDITIONAL IMPORTANT INFORMATION:**

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

**INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED**

Send Permit Applications to:
Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

**SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.**



F-1a

# Papahānaumokuākea Marine National Monument
# Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

## Summary Information

**Applicant Name:** Carl G. Meyer
**Affiliation:** Hawaii Institute of Marine Biology

**Permit Category:** Research
**Proposed Activity Dates:** May 1st-Oct 30 2011
**Proposed Method of Entry (Vessel/Plane):** Vessel
**Proposed Locations:** Necker, Nihoa, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Lisianski, Laysan, Pearl & Hermes Reef, Midway, Kure

**Estimated number of individuals (including Applicant) to be covered under this permit:** 8
**Estimated number of days in the Monument:** 70

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would…

Quantify the movements and trophic ecology of top predators (sharks and large fishes) in the Monument to: (1) improve our broad understanding of Monument ecology, (2) provide further specific insight into shark predation on Hawaiian monk seals at French Frigate Shoals Atoll, and (3) elucidate the role of deep reefs in the ecology of Monument predators.

b.) To accomplish this activity we would ….

Capture and equip top predators with electronic tags, and monitor their movements using acoustic receivers (deployed on the sea floor). Collect small, non-lethal tissue samples from top predators for chemical analysis to determine feeding habits. Collect reference isotopic samples from deep and shallow reefs by: (1) lethal sampling of 120 reef fishes (collected via 3-prong pole spear), and (2) sampling benthic algae and phytoplankton. These reference samples will be used to determine the trophic position and feeding location of predators.

c.) This activity would help the Monument by …

Our research will provide Monument managers with information on the movements patterns and feeding habitats of culturally and ecologically important top predators. We will quantify how deep sharks and large fishes such as ulua range, and begin to assess the depths at which these predators routinely forage to determine where competitive overlap may exist between these species and Hawaiian monk seals. We will provide Monument managers with empirical data on shark movement patterns and diet at French Frigate Shoals atoll. This information is vital for a better understanding of shark predation on Hawaiian monk seals and for selecting appropriate management strategies for mitigating predation impacts on monk seals. We will also provide new information on the importance of a key habitat type (mesophotic deep reefs) in the Monument, to the ecology of top predators.

**Other information or background:** Our research has minimal impact on monument resources. Sharks and other predators are captured, tagged and released at their capture locations. Our listening stations (acoustic receiver + moorings) are designed to have minimal substrate impact and leave nothing behind when they are removed. We are requesting to lethally sample only 120 of the most common reef fishes. Principal Investigator Carl Meyer has previously consulted with William Aila about the cultural implications of this research. Mr. Aila is very familiar with our research, having both observed and assisted us during shark tagging activities conducted at French Frigate Shoals in June 2010. This provided a valuable opportunity for Carl Meyer to discuss at length with Mr. Aila the challenges associated with balancing cultural concerns against the need for directed management of Monument resources, including the gathering of scientific knowledge.

## Section A - Applicant Information

**1. Applicant**

Name (last, first, middle initial): Meyer, Carl, G.

Title: Assistant Researcher

**1a. Intended field Principal Investigator (See instructions for more information):**
Carl Meyer

**2. Mailing address (street/P.O. box, city, state, country, zip):** [redacted]

Phone: [redacted]

Fax: [redacted]

Email: [redacted]

For students, major professor's name, telephone and email address: NA

**3. Affiliation (institution/agency/organization directly related to the proposed project):**
University of Hawaii, Hawaii Institute of Marine Biology

**4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):**
Yannis Papastamatiou, Research Diver, Field Technician
Jon Dale, Research Diver, Field Technician
Christian Clark, Research Diver, Field Technician
Melanie Hutchinson, Research Diver, Field Technician
Carl Meyer, Research Diver, Principal Investigator
Randy Kosaki, Research Diver, Field Technician
TBD
TBD

## Section B: Project Information

**5a. Project location(s):**

| | | Ocean Based | |
|---|---|---|---|
| ☒ Nihoa Island | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Necker Island (Mokumanamana) | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ French Frigate Shoals | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Gardner Pinnacles | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Maro Reef | | | |
| ☒ Laysan Island | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Lisianski Island, Neva Shoal | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Pearl and Hermes Atoll | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Midway Atoll | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☒ Kure Atoll | ☐ Land-based | ☒ Shallow water | ☒ Deep water |
| ☐ Other | | | |

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:
Fishing/Tagging
Fish capture and tagging will be ship-based and will occur in the shallow waters around the Monument locations listed above.

Receiver Deployment and Recovery
A total of 48 receivers are currently deployed at 9 islands/atolls in the Monument (Appendix 1). Our goal is to service and redeploy these existing receivers to provide continued monitoring coverage within the Monument. We are also requesting 4 additional receiver deployments at FFS (2) and PHR (2) to extend our listening coverage at these atolls into deeper, mesophotic habitats. Exact locations of new deployments will be recorded using a handheld GPS. In addition we plan to swap out up to 8 Ecological Acoustic Recorder units (EARs) that are already co-located with several of our acoustic receivers. EARs have been deployed in the Monument by Dr. Marc Lammers (HIMB/NOAA) in order to monitor biological (e.g. whale song) and manmade (boat engine noise) sounds.

Reef fish collection
Reef fishes will be collected using pole spears in shallow waters and on mesophotic reefs (depth 150-300ft) at FFS and PHR.

Algal Reference Sample collection
Algal samples will be collected by hand from shallow and mesophotic reefs at FFS & PHR

Plankton Samples
Plankton samples will be collected using towed plankton nets in the waters around FFS & PHR

**5b. Check all applicable regulated activities proposed to be conducted in the Monument:**

☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource

☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands

☒ Anchoring a vessel

☐ Deserting a vessel aground, at anchor, or adrift

☒ Discharging or depositing any material or matter into the Monument

☐ Touching coral, living or dead

☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument

☒ Attracting any living Monument resource

☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)

☐ Subsistence fishing (State waters only)

☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

**6 Purpose/Need/Scope** ***State purpose of proposed activities:***
(a) Purpose of proposed activities
The purpose of this research is to provide managers with empirical data on top predator movement patterns and feeding habitats in Monument waters. A major component of this work involves quantifying shark movements and feeding ecology at FFS to provide insight into predation on critically-endangered Hawaiian monk seal pups. This information is needed for selecting appropriate management strategies for these culturally and ecologically important sharks and fishes. We have the following specific goals and objectives;

1. Download 48 underwater receivers currently stationed in the Monument to retrieve stored movement data from 240 top predators tagged with acoustic transmitters from 2008 to 2010.

2. Determine how widely these animals have ranged since August 2010 and identify their patterns of movement. Particular emphasis will be placed on determining the frequency and timing of visits by Galapagos and tiger sharks to monk seal pupping sites at FFS atoll.

3. Extend our receiver coverage to mesophotic habitat by deploying 4 additional underwater receivers at FFS (2) and PHR (2).

4. Equip up to 80 additional ulua and Galapagos sharks (20 of each species at FFS and PHR) with pressure-sensor acoustic transmitters detectable by our listening array. These tag deployments will enable us to obtain the first insights into 'upslope-downslope' movements between shallow and mesophotic habitats by abundant monument predators.

5. Enhance our overall understanding of predator spatial dynamics at FFS by quantifying the movements of four abundant shark species (sandbar, reef whitetip, grey reef, blacktip) and three teleosts (amberjack, blue trevally, and kawa kawa) for which we currently lack movement data. We aim to equip up to 20 individuals of each species with acoustic transmitters. This will take advantage of the listening array already in situ at FFS, and allow for simultaneous comparison with movement patterns of tiger (N=39) and Galapagos sharks (N=68) tagged at FFS in 2009.

6. Deploy tri-axial accelerometer + digital camera data loggers on up to 5 ulua and 5 Galapagos or tiger sharks at FFS to provide high resolution information on swimming patterns and habitat use.

7. Collect small samples of muscle tissue from predators (uluas and galapagos sharks) for chemical analyses (stable isotopes), from FFS and P&H to provide insight into predator feeding habits (40 samples per atoll). A small, non-lethal biopsy will be taken from each predator during tagging activities. To establish the chemical composition of prey species, tissue samples will be collected from 120 reef fishes collected at shallow and deep locations at FFS & PHR. To determine baseline stable isotope signatures, we will also collect samples of benthic algae (800g) and phytoplankton (800g) from FFS and P&H.

(b) Need for proposed activities

Top predators play an important role in many ecosystems and in Monument waters this role is filled by sharks (primarily tiger, galapagos, gray reef and whitetip reef sharks) and large teleost fishes (primarily ulua) (DeCrosta, Wetherbee et al. 1997, Friedlander & DeMartini 2002, Holzwarth et al. 2006, Papastamatiou et al., 2006). Science-based management of the marine top predators of the Hawaiian archipelago requires that we know whether key species are site-attached to specific areas or, if not, how frequent and extensive are their movements. Since 2005 we have been using a combination of acoustic and satellite tags to quantify top predator movements in the Monument, and address three broad questions relevant to management zoning; (1) Do top predators move across open ocean between atolls?, (2) How extensive are their intra-atoll movements?, and (3) Do top predators exhibit predictable patterns of movement and habitat use?

Using these technologies we have already made substantial progress in quantifying predator movement patterns in Monument waters (see Meyer et al. 2007a,b, Meyer et al. 2009, 2010). For example, we have shown that tiger sharks routinely swim between atolls, range along the entire Hawaiian archipelago and venture hundreds of miles beyond Monument boundaries into open-ocean. We also obtained the first empirical evidence that gray reef sharks swim across open-ocean between atolls. We have found other top predators (e.g. ulua, Galapagos sharks) are site-attached to individual atolls, but wide-ranging within their 'home' atoll (e.g., Meyer et al., 2007a,b, 2010). We discovered that ulua & uku have predictable patterns of movement, including diel habitat shifts and tidal & lunar rhythmicity (Meyer et al., 2007a,b). We also found that during summer full moons, ulua from all over French Frigate Shoals atoll converge on one particular location where they form large spawning aggregations (Meyer et al., 2007a).

Although we have already made substantial progress in quantifying predator movement patterns in Monument waters, important questions remain unanswered. We have gained considerable insight into the horizontal movements of Monument predators but we still know very little about their vertical movements. For example, we don't know to what depths abundant Monument predators such as ulua range, or whether they forage at both shallow and meso-photic depths, thus the trophic links between shallow and deep mesophotic reefs are poorly understood. These questions have important implications for understanding ecosystem function and resolving important management questions such as whether ulua are competing for food with critically endangered monk seals. Recent surveys of mesophotic reefs in the Monument suggest that these areas maybe important habitat for several life stages of reef fishes and invertebrates, highlighting the importance of understanding the links between mesophotic and shallow reefs.

In addition to providing a broad understanding of predator movements in Monument water, we have also been quantifying movements of Galapagos and tiger sharks at FFS to provide specific insight into shark predation on Hawaiian monk seal pups at this location. The Hawaiian monk seal (Monachus schauinslandi) is critically endangered with approximately 1,200 seals remaining and the total population size projected to fall below 1000 within the next five years. Among the six primary breeding sites in the NWHI, French Frigate Shoals (FFS) has experienced the most dramatic decline, with beach counts at FFS declining 70% from 1989-2004 (Antonelis et al. 2006, Caretta et al., 2007). The main demographic factors in the decline have been poor juvenile

survival (pup mortalities at FFS range from 15-69% of each annual cohort), exacerbated by lower reproductive rates as compared to other breeding sites in the NWHI (Harting et al. 2007). Shark predation is suspected to be the single greatest cause of mortality for pre-weaned Hawaiian monk seal pups at FFS, with a small number of persistent Galapagos sharks thought to be the primary culprits (although historically tiger sharks were considered the main predator of monk seals). However, most pup predation is not seen and questions remain about the numbers and species of sharks involved. To resolve these important questions we equipped Galapagos (N=89) and tiger sharks (N=54) at FFS with acoustic transmitters in 2008 and 2009, and deployed acoustic 'fences' of underwater receivers around monk seal pupping sites. Our experimental design will allow us to address the following specific questions;

(1) How frequently do large sharks (tiger and galapagos) visit monk seal pupping sites?

(2) Do shark visits to monk seal pupping sites have predictable patterns?

(3) What proportion of all Galapagos and tiger sharks tagged at FFS visit pupping sites?

(4) Do individual sharks visit multiple pupping sites?

(5) How do shark movement patterns vary over time?

We need to return to FFS and download our receivers in order to recover data that will enable us to answer the above questions.

(c) Scope of proposed activities
We propose to recover, download and redeploy up to 48 receivers already stationed in Monument waters (see Appendix 1). This will enable us to recover another 12 months of predator movement data (summer 2010-summer 2011) and to continue monitoring our transmitter-equipped predators in order to determine how their movement patterns vary over multiyear time-scales. We also propose deploying four additional underwater receivers in Monument waters in order to extend our monitoring coverage into mesophotic habitats at FFS (2 receivers) and PHR (2 receivers). This would increase the total number of receivers deployed in Monument waters to 52. In order to quantify the vertical (depth) movements of ulua and Galapagos sharks, we propose implanting pressure-sensor acoustic transmitters (to quantify swimming depth) into 20 individuals from each species at both PHR & FFS (i.e. 40 total ulua & 40 total Galapagos sharks). To provide additional, high-resolution data on movement patterns and habitat use, we are also proposing to deploy accelerometer-digital camera data loggers on 5 ulua and 5 Galapagos or tiger sharks at FFS. At FFS, we propose implanting acoustic transmitters into up to 20 individuals from each of four shark species (grey reef, blacktip, sandbar, whitetip reef - up to 80 total sharks tagged) and three teleosts (amberjack, blue trevally, kawa kawa) to provide movement and habitat use data for comparison with Galapagos and tiger sharks tagged in 2009. Thus we are requesting up to 230 new transmitter deployments & predator biopsy samples (all species combined).

We also aim to swap out up to 8 Ecological Acoustic Recorders (EARs) already co-located with our receivers. These EAR units have been deployed as part of an ecosystem noise monitoring program conducted by Dr. Marc Lammers (HIMB/NOAA).

To quantify trophic ecology of predators, we will obtain muscle biopsies from all galapagos sharks and uluas captured (up to 90 total). We will analyze the isotopic content of muscle tissue to determine carbon:nitrogen ratios, which will provide insight into the trophic levels of these animals and where they are foraging. To ground truth carbon values, we will also collect 30 individual reef fishes (from the 3 most common species) at each of 4 sites (two sites per atoll at FFS and P&H , 120 fish total). At each atoll we will collect fishes from a mesophotic reef and a shallow water (30-60ft) comparison site. We will collect 10 individuals each from three species per site. To reduce impact, we will sample individuals of only the most abundant species present on the mesophotic reefs. This is also scientifically valid as we aim to sample "prey species" which are likely to be the most abundant species present.

Based on records from previous mesophotic dives, we have identified shortlists of fish species most commonly seen on mesophotic reefs at FFS (N=9) & PHR (N=8). We cannot be certain of the identity of the three most abundant species until divers are in situ on mesophotic reefs but they will be drawn from the following list;

FFS - Mesophotic fishes
Luzonichthys earlei
Pseudanthias thompsoni
Pseudanthias hawaiiensis
Holanthias fuscipinnis
Chromis verater
Chromis leucura
Parupeneus multifasciatus
Chaetodon miliaris
Myripristis chryseres

PHR - Mesophotic fishes
Pseudanthias thompsoni
Pseudanthias hawaiiensis
Holanthias fuscipinnis
Chromis verater
Coris ballieui
Parupeneus chrysonemus
Chaetodon miliaris
Myripristis chryseres

We will collect the following species at shallow water sites;

Acanthurus nigroris
Parupeneus multifasciatus

Thalassoma ballieui

We will select shallow water collection sites that are directly inshore from the mesophotic collection sites. Experienced collecters will use three-prong spears to capture reef fishes at both shallow and mesophotic sites;

Mesophotic fish collectors
Randy Kosaki
Yannis Papastamatiou
Christian Clark
TBD
TBD

Shallow fish collectors
Randy Kosaki
Yannis Papastamatiou
Jon Dale
Christian Clark
Melanie Hutchinson
Carl Meyer
TBD
TBD

Finally, we will collect samples of benthic algae (800g) and phytoplankton (800g) from deep and shallow reefs to quantify isotope signatures at the base of the food chain. We can then determine whether the sampled predators are foraging on deep or shallow reefs at these atolls. For each atoll, we aim to collect the same species at both deep and shallow reefs. Note that to minimize temporal variation in isotope signatures, tissue samples from predators/reef fish/algae need to be collected at the same time (i.e. we cannot use tissues from frozen specimens collected in previous years).

**7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:**

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?
The activity will be conducted with adequate safeguards for the resources and ecological integrity of the Monument. For top predators we use non-lethal catch and release, and telemetry techniques that have minimal impact on the resources and ecological integrity of the Monument. Some reef fishes will be lethally sampled, but only at very low numbers per site (10 individuals per species), and overall (120 fish total from 2 atolls). We will also share specimens with other researchers for genetic analysis and life history characterization so that lethally-sampled fishes

are fully utilized. This project is a continuing effort to quantify top predator movements and feeding ecology throughout the NWHI for the purpose of informing management. Principal Investigator Carl Meyer has previously consulted with William Aila about the cultural implications of this research. Mr. Aila is very familiar with our research, having both observed and assisted us during shark tagging activities conducted at French Frigate Shoals in June 2010. This provided a valuable opportunity for Carl Meyer to discuss at length with Mr. Aila the challenges associated with balancing cultural concerns against the need for directed management of Monument resources, including the gathering of scientific knowledge.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?
The proposed activities will have minimal impact on the resources of the region. The top predator tracking research consists of non-lethal catch and release, and acoustic monitoring. A very limited amount of lethal sampling (120 reef fishes total, 10 per sample site; 800g benthic algae, 800g plankton) will be conducted at two atolls. This research is being conducted in concert with the priorities listed in Monument research plan for the Monument. The scientific knowledge provided by these activities will help managers to better navigate controversial issues such as culling sharks to reduce predation on monk seal pups, where cultural concerns are being weighed directly against directed management of critically endangered species.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.
There is no practicable alternative to conducting activities in the Monument. We are addressing questions that are directly relevant to management of Monument resources (we are quantifying movement patterns & feeding ecology of top predators throughout the Monument), hence the study must be carried out within the Monument

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?
The management value of data produced by our research activities outweighs the minor, transient impacts on Monument resources. The methods and procedures that we are proposing will have minimal impacts on Monument resources, qualities, and ecological integrity. No predators will be removed from the Monument and we have empirical data showing that tagged predators resume normal patterns of behavior soon after release (e.g., Meyer et. al. 2007a,b, 2009, 2010). Low numbers of reef fishes will be removed from the monument, but these will provide valuable data on a little-studied habitat that is an important component of the monument (mesophotic reefs). Our receivers are stationed on uncolonized habitats, and removal will leave no evidence of their presence (see Appendix 2). The scientific knowledge provided by these activities will help managers to better navigate controversial issues such as culling sharks to reduce predation on monk seal pups, where cultural concerns are weighed directly against directed management of critically endangered species.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.
The actual fieldwork component of this research involves the minimum time required to reach the desired sample size of sharks and fishes based on historical catch rates. The monitoring of predator movements is done remotely using small receivers left in situ year-round. The multi-year overall time frame of our proposed activities is consistent with our objectives of quantifying long-term movement patterns of predators in Monument waters. Long-term studies are essential for identifying seasonal movements and determining how movement patterns vary over multiyear time-scales.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
The principle investigator has more than 15 years of experience conducting this type of research (see attached CV for details) and is well qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct. All personnel included in this permit application have extensive experience conducting research in the Monument, and in acoustic monitoring techniques. Two individuals (Papastamatiou and Dale) also have extensive experience performing stable isotope analysis on fish tissues. The Stable Isotope Laboratory at the University of Hawaii Manoa will assist in analysis of samples, under the guidance of Dr Brian Popp. This is a continuance of a multi-year project.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.
Our research is supported by an award to Hawaii Institute of Marine Biology from the National Marine Sanctuary Program, and we are provided access to the Monument on NOAA research vessels. These resources are adequate to conduct and complete the proposed activities and mitigate any potential impacts resulting from its conduct.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.
The methods and procedures that we are proposing are ideal for achieving our goals with minimal impacts to Monument resources, qualities, and ecological integrity. The use of passive monitoring techniques (self-contained acoustic receivers and satellite telemetry) means that we need relatively little human access to the Monument in order to achieve continuous, year-round monitoring of predator movements. No top predators will be removed from the Monument as a result of our research, and we have empirical data showing that tagged predators resume normal patterns of behavior soon after release (e.g., Meyer et. al. 2007a,b, 2010). Our receivers are stationed on uncolonized habitats, and removal will leave no evidence of their presence (see Appendix 2). A very limited amount of lethal sampling (120 reef fishes total, 10 per sample site; 800g benthic algae; 800g plankton) will be conducted at two atolls.

i. Has your vessel has been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?
NOAA vessels are equipped with the NOAA OLE Vessel Monitoring System

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.
We have met all requirements of previously issued permits for research work in PMNM. There are no other factors that would make the issuance of a permit for our proposed activities inappropriate.

**8. Procedures/Methods:**
Activities will be carried out from small boats launched from NOAA vessel Hi'ialakai and will not require any terrestrial access. Servicing of receivers will be done by snorkelers and SCUBA divers. Our chosen method (remote acoustic monitoring) is ideal for quantifying animal movements in remote, environmentally-sensitive locations because it has minimal environmental impact and requires only occasional, brief access by researchers to individual study sites, yet provides continuous monitoring of animal movements at those sites.

(a) Deployment of underwater receivers in mesophotic habitats
We will deploy 4 underwater receivers at two sites each at Pearl and Hermes and French Frigate Shoals atoll (4 sites total) in May 2011. Side scan sonar mapping and depth sounders will be utilized to select flat, uncolonized habitat adjacent to ledges at depths of between 200-300ft. Receivers will be attached to weighted (with chain links) moorings , and lowered to the sea floor so that they land on the flat habitat. The receivers will be suspended 4 m above the ocean floor, and will identify and record the presence of any acoustic transmitters within range (up to 500 m). The transmitter number, time of arrival and departure and the date will be recorded and stored until the data are downloaded from the receivers to a computer. The receivers have a battery life of approximately 15 months and will be serviced at 6 to 12 month intervals. These receivers will be initially recovered and re-deployed during deep technical dives in July 2011.

(b) Data retrieval, reduction and analysis.
We will download receivers currently deployed in Monument waters (Appendix 1). Data downloading consists of interfacing the receiver to a computer via a wireless 'bluetooth' connection, and can be accomplished in the field. Preliminary data reduction and analyses will commence after downloading.

(c) Deployment of acoustic transmitters
We will implant acoustic transmitters into up to 180 sharks and fishes captured in monument waters. Our predator handling & tagging activities will be carried out in accordance with the animal use protocols of the University of Hawaii (protocol #05-053). Ulua will be captured by trolling (using an artificial lure)and handlining (using a single baited hook) from a small skiff. Sharks will be captured by handlining (using a single baited hook) from a small skiff and using a bottom-set, 10 hook shark line. Captured sharks and ulua will be brought alongside the skiff, tail-roped and inverted to initiate tonic immobility for transmitter implantation. We will implant coded acoustic transmitters (V16 & V16P, 16 mm diameter, 90 mm long, Vemco, Halifax, Nova Scotia) into the body cavities of each predator through a small incision in the abdominal wall

(Holland et al., 1999; Meyer & Honebrink 2005, Meyer et al. 2007a,b, 2010). The incision will then be sutured closed, a small tissue sample will be taken from the dorsal musculature (see also below), the hook removed and the predator released. This entire handling process can be completed in less than 10 minutes. Every fish captured and equipped with an acoustic tag will also receive an external dart tag.

Previous reviews of the above capture procedures have prompted a series of questions about potential impacts on other species. To provide additional information we have included these questions and our responses;

1. What kind of by-catch is likely to occur?

Trolling by-catch includes reef-associated piscivores attracted to artificial lures, primarily uku (Aprion virescens). Baited handlines and sharklines very rarely catch anything other than target species. Any non-target species (other sharks, very occasional large ulua) are released.

2. How can by-catch be minimized or mitigated?

Non-target fishes captured by trolling are immediately released. If by-catch becomes more than occasional then trolling is ceased in that area.

3. Are lines an entanglement hazard for seals? What mitigation measures are taken?

No. Handlines (baited and trolled) are manned constantly. We have not been approached by seals while using these methods. We have never had any seal interactions with bottom-set shark lines. These are heavy gauge lines with heavy end-weights and large surface floats, resulting in a 'taut' deployment, greatly reducing entanglement risks. As an added precaution we constantly monitor any such lines set within 1 km of seal haul-out sites.

4. Has there been any seabird interaction with the fishing gear?

Seabirds are sporadically attracted by trolling activities. Fishing is ceased and lines retrieved whenever birds show interest in the fishing gear. By taking these precautions we have avoided any physical interactions between birds and trolling gear.

(d) Deployment and recovery of accelerometer-digital camera dataloggers

Shark and ulua capture methods for accelerometer deployment methods are identical to those described in item (c) above. Each datalogger package will consist of a tri-axial accelerometer (W1000L-PD3GT, 22 mm in diameter, 123 mm in length, 90 g in air; Little Leonardo Co., Tokyo, Japan) and a digital camera (DSL380-VDT□□, 22 mm in diameter, 132 mm in length, 83 g in air; Little Leonardo Co., Tokyo, Japan), attached to a float equipped with a VHF transmitter and timed release mechanism (see picture - Appendix 4).

Accelerometers record swimming speed, depth, temperature (at 1 s intervals), and tri-axial acceleration (at 1/32 s intervals, 32 Hz). Digital cameras capture still images (1MB pixels) at 4 sec intervals, and record depth and temperature at 1 sec intervals. Total device weights in air are 311g, and their buoyancies are offset by 76 g in sea water. The accelerometer package will be attached to the dorsal fin of each shark by plastic cable ties secured through two small holes drilled through the fin (see picture - Appendix 4). The devices will be attached to the second dorsal fin of each ulua using plastic cable ties secured through small holes through the superficial dorsal musculature below the dorsal fins. After 24-48 h, a pre-programmed release timer will cause the instruments to detach and float to the surface, where they will be located using the VHF transmitter and retrieved.

(e) Collection of tissue biopsies from predators
Predator capture methods for tissue biopsy collections are identical to those described in item (c) above. We will collect small muscle biopsies from all predators captured. This involves making a small incision in the skin and using a biopsy tip to remove approximately 0.5 cc of muscle. These samples will be collected while predators are restrained for tagging. Tissue samples will be transferred to small plastic vials, frozen and transported back to Honolulu for laboratory analyses (stable isotope content).

(f) Collection of tissue biopsies from prey species
To obtain reference 'signatures' of chemical composition of potential prey (smaller reef fishes), we will lethally collect a total of 120 reef fishes from FFS and P&H (2 sites per atoll, 30 total fish per site). We will sample 10 individuals from each of three species at each site. At each atoll, one site will consist of a mesophotic reef and the other an adjacent shallow reef (30-60ft range). Muscle tissue will be obtained from each species for stable isotope analysis. We will also send the remains of specimens to Dr. Brian Bowen and Eric Franklin for genetic and life history analysis. The latter are collecting specimens to quantify genetic connectivity between Monument locations and between mesophotic and shallow reef sites. We will also collect benthic algae by hand and use plankton trawls to sample phytoplankton at the four sites. These will be used to quantify the isotopic signature at the base of the food chain. Plankton nets will be rinsed in ethanol between sites to ensure no transfer of micro-organisms between locations. Note that to minimize temporal variation in isotope signatures, tissue samples from predators/reef fish/algae need to be collected at the same time (i.e. we cannot use tissues from frozen specimens collected in previous years).

(g) Chemical analyses of tissue samples

Stable isotopes: The composition of heavy isotopes in an animal's tissues reflects that of its food, and the isotopic signature of the primary producers in the ecosystem. The 15N: 14N ratio is an indicator of a predator's trophic position in the food web, while the 13C: 12C ratio highlights the source of carbon for the primary producers at the base of the food chain from which the predator is feeding (e.g. coastal or pelagic, France 1995, Post 2002). Samples will be frozen until they are processed at the stable isotope laboratory at the University of Hawaii at Manoa. Samples are dried in a 60 °C drying oven for at least 48 h or until the sample are completely dried out, and then ground into a fine powder and weighed out into micro sampling dishes. We will use a

carbon-nitrogen analyzer (Finnigan ConFlo II/Delta-Plus, Bremen, Germany) to determine the relative concentration of heavy 15N and 13C in each sample. Values are presented as ‰, relative to standards of V-PDB and atmospheric N2 for 13C and 15N respectively.

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Meyer CG, Papastamatiou YP, Holland KN. 2007b. Seasonal, diel and tidal movements of green jobfish (Aprion virescens, Lutjanidae) at remote Hawaiian atolls: Implications for Marine Protected Area design. Marine Biology. 151: 2133-2143.

Meyer CG, Clark TB, Papastamatiou YP, Whitney NM, Holland KN. 2009. Long-term movements of tiger sharks (Galeocerdo cuvier) in Hawaii. Marine Ecology Progress Series. 381: 223–235.

Meyer CG, Papastamatiou YP, Holland KN. 2010. A multiple instrument approach to quantifying the movement patterns and habitat use of Tiger (Galeocerdo cuvier) and Galapagos sharks (Carcharhinus galapagensis) at French Frigate Shoals, Hawaii. Marine Biology. 157:1857–1868. DOI: 10.1007/s00227-010-1457-x

Papastamatiou YP, Wetherbee BM, Lowe CG, Crow GC. 2006. Distribution and diet of four species of carcharhinid shark in the Hawaiian Islands: evidence for resource partitioning and competitive exclusion. Marine Ecology Progress Series 320: 239-251

Post D.M., 2002. Using stable isotopes to estimate trophic position: models, methods, and assumptions. Ecology 83(3): 703-718

Wetherbee BM, Crow GL and CG Lowe (1997). Distribution, reproduction and diet of the gray reef shark Carcharhinus amblyrhynchos in Hawaii. Marine Ecology Progress Series 151: 181-189.

**NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application.**

**9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):**

Common name:
Please refer to Appendix 5

Scientific name:
Please refer to Appendix 5

# & size of specimens:
Please refer to Appendix 5

Collection location:
Please refer to Appendix 5

☒ Whole Organism ☒ Partial Organism

**9b. What will be done with the specimens after the project has ended?**
The animal tissue samples will be utilized for stable isotope analysis. Remains of reef fishes will be passed on to researchers studying genetic conductivity and life history characteristics in the monument. Phytoplankton samples will be fixed and utilized for stable isotope analysis.

**9c. Will the organisms be kept alive after collection? ☐ Yes ☒ No**

• General site/location for collections:
Please refer to Appendix 5

• Is it an open or closed system? ☐ Open ☐ Closed
N/A

• Is there an outfall? ☐ Yes ☐ No
N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?
N/A

• Will organisms be released?
Predators = yes - see procedures section 8 c & e above.
Prey items = no. Reef fishes will be sacrificed.

**10. If applicable, how will the collected samples or specimens be transported out of the Monument?**
Muscle tissue samples,whole reef fish, algae and plankton samples will be stored frozen in plastic vials for transport out of the Monument.

**11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:**
We will share all reef fish specimens with researchers studying genetic conductivity in the monument (Dr Brian Bowen) and life history characteristics of reef fishes (Eric Franklin). These data will be used in collaboration with other proposed projects. Brian Popp (UH-SOEST) will be using stable isotopes to determine if there is a difference in signal between shallow and deep counterparts, which will be required if we are to determine if predators are foraging on deep reefs. We will swap out EARs for Marc Lammers (UH-HIMB/NOAA) during our receiver recovery dives (these units are currently co-located with our acoustic receivers).

**12a. List all specialized gear and materials to be used in this activity:**
Please refer to Appendix 3

**12b. List all Hazardous Materials you propose to take to and use within the Monument:**

N/A

**13. Describe any fixed installations and instrumentation proposed to be set in the Monument:**
Please refer to Appendix 2

**14. Provide a time line for sample analysis, data analysis, write-up and publication of information:**
Analyses & interpretation of data are ongoing. An update on shark spatial dynamics at FFS will be ready by December 2011. We already have seven manuscripts derived from our PMNM studies published, or in press, in international peer-reviewed journals.

**15. List all Applicants' publications directly related to the proposed project:**
Meyer CG, Papastamatiou YP, Holland KN. 2007. Seasonal, diel and tidal movements of green jobfish (Aprion virescens, Lutjanidae) at remote Hawaiian atolls: Implications for Marine Protected Area design. Marine Biology. 151: 2133-2143.

Meyer CG, Holland KN, Papastamatiou YP. 2007. Seasonal and diel movements of giant trevally (Caranx ignobilis) at remote Hawaiian atolls: implications for the design of Marine Protected Areas. Marine Ecology Progress Series. 333: 13-25.

Meyer C.G., T.B. Clark, Y.P. Papastamatiou, N.M. Whitney, & K.N. Holland. (2009). Long-term movements of tiger sharks (Galeocerdo cuvier) in Hawaii. Marine Ecology Progress Series. 381: 223-235.

Meyer CG, Papastamatiou YP, Holland KN (2010). A multiple instrument approach to quantifying the movement patterns and habitat use of tiger and Galapagos sharks at French Frigate Shoals, Hawaii. Marine Biology 157: 1857-1868

Papastamatiou YP, Friedlander AM, Caselle JE, Lowe CG. 2010. Long term movement patterns and trophic ecology of blacktip reef sharks (Carcharhinus melanopterus) at Palmyra Atoll. Journal of Experimental Marine Biology and Ecology 386: 94-102

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Dale JJ, Stankus AM, Burns MS, Meyer CG. 2011. The Shark Assemblage at French Frigate Shoals Atoll, Hawai'i: Species Composition, Abundance and Habitat Use. PLoS ONE. In Press.

Nakamura I, Watanabe YY, Papastamatiou YP, Sato K, Meyer CG. 2011. Yo-yo vertical movements suggest a foraging strategy for tiger sharks Galeocerdo cuvier. Marine Ecology Progress Series. In Press.

Dale JJ, Meyer CG, Clark CE. 2011. The ecology of coral reef top predators in the Papahanaumokuakea Marine National Monument. Journal of Marine Biology. In Press.

Gil Iosilevskii G, Papastamatiou YP, Meyer CG, Holland KN (in review) Why do sharks perform vertical "Yo-Yo" dives? A reverse engineering approach to tiger shark Galeocerdo cuvier swimming. Journal of Theoretical Biology

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

Signature Date

**SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:**

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

**DID YOU INCLUDE THESE?**

☒ Applicant CV/Resume/Biography
☐ Intended field Principal Investigator CV/Resume/Biography
☐ Electronic and Hard Copy of Application with Signature
☐ Statement of information you wish to be kept confidential
☐ Material Safety Data Sheets for Hazardous Materials

**Appendix 1 – Carl Meyer – Acoustic Receiver Locations**

| Atoll | Location Description | Latitude | Longitude | Depth (ft) |
|---|---|---|---|---|
| FFS | Rapture Reef | 23.63509 | -166.18570 | 85 |
| FFS | Gins | 23.72615 | -166.16967 | 37 |
| FFS | Big Gin Bay | 23.73355 | -166.16612 | 5 |
| FFS | Big Gin Point | 23.73542 | -166.16696 | 9 |
| FFS | SE of La Perouse | 23.74926 | -166.21773 | 70 |
| FFS | La Perouse | 23.76945 | -166.26208 | 30 |
| FFS | East Island | 23.78686 | -166.20709 | 10 |
| FFS | NE of La Perouse | 23.80545 | -166.26106 | 72 |
| FFS | Round & Mullet | 23.82747 | -166.22857 | 10 |
| FFS | Tern Island | 23.86664 | -166.28820 | 10 |
| FFS | Trig Island | 23.86945 | -166.24158 | 15 |
| FFS | Outside Trig | 23.86945 | -166.24158 | 15 |
| FFS | Trig Island | 23.87117 | -166.24220 | 4 |
| FFS | Trig Island | 23.87124 | -166.24323 | 4 |
| FFS | Trig Island | 23.87127 | -166.24102 | 3 |
| FFS | Trig Island | 23.87135 | -166.24435 | 3 |
| FFS | East Tern | 23.87135 | -166.28203 | 6 |
| FFS | Trig Island | 23.87194 | -166.24138 | 13 |
| FFS | Trig Island | 23.87200 | -166.24205 | 5 |
| FFS | Trig Island | 23.87205 | -166.24297 | 3 |
| FFS | Trig Island | 23.87206 | -166.24529 | 5 |
| FFS | Trig Island | 23.87220 | -166.24353 | 4 |
| FFS | Trig Island | 23.87237 | -166.24432 | 4 |
| FFS | Northern Barrier Reef | 23.88183 | -166.29223 | 147 |
| FFS | Northern Barrier Reef | 23.88183 | -166.29223 | 147 |
| FFS | North of Trig | 23.88609 | -166.22641 | 150 |
| Gardner | West Cove | 24.99834 | -167.99982 | 51 |
| Kure | SE Channel | 28.38183 | -178.30860 | 60 |
| Kure | West Channel East Side | 28.38897 | -178.36187 | 50 |
| Kure | West Channel | 28.40388 | -178.37508 | 70 |
| Kure | Eastern Barrier Reef | 28.42502 | -178.28172 | 80 |
| Kure | North Barrier Reef | 28.46045 | -178.32629 | 90 |
| Laysan | South End | 25.75463 | -171.71562 | 66 |
| Laysan | West Cove Channel | 25.77395 | -171.74248 | 30 |
| Lisianski | South Neva Shoals | 25.88237 | -173.91573 | 85 |
| Lisianski | East Side of Island | 26.05728 | -173.95957 | 14 |
| Maro | North Tip | 25.45842 | -170.67104 | 55 |
| Maro | Shark Point | 25.46057 | -170.68168 | 65 |
| Midway | Frigate Point | 28.19117 | -177.39450 | 30 |
| Midway | Fish Hole | 28.19742 | -177.36272 | 40 |
| Midway | North Barrier Reef | 28.28610 | -177.36212 | 90 |
| Nihoa | West Side | 23.05942 | -161.93058 | 40 |
| PHR | SW Corner | 27.75290 | -175.94805 | 50 |
| PHR | SE Channel | 27.78702 | -175.83623 | 30 |
| PHR | Main Channel -West Side | 27.79092 | -175.86300 | 35 |
| PHR | West Spur and Groove | 27.80215 | -176.01095 | 100 |
| PHR | NE Side | 27.90115 | -175.72205 | 65 |
| PHR | NW Side | 27.91095 | -175.90890 | 85 |

**Appendix 2 Receiver installations in the Monument**

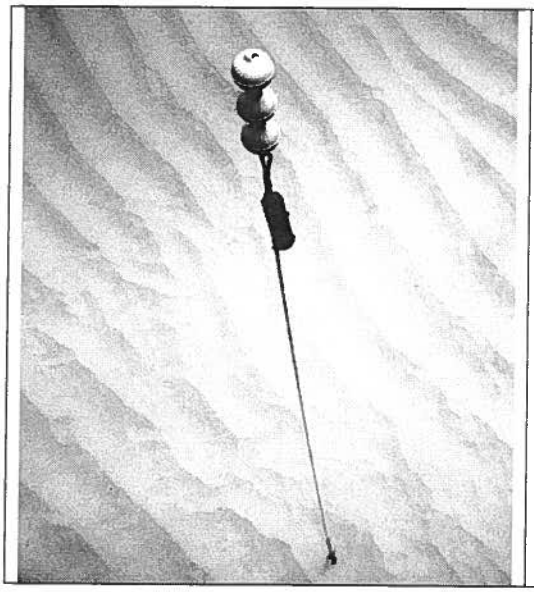
We use Vemco VR2 underwater receivers for monitoring movements of transmitter-equipped predators. The VR2 consists of a hydrophone, receiver, ID detector, data logging memory, and battery all housed in a submersible plastic case.

Vemco VR2 Receiver

Each receiver is mounted on a mooring consisting of an anchor (either a sand screw, or chain around uncolonized hard substrate), rope bridle and subsurface floats.

| | |
|---|---|
|  | We use 4 ft steel sand screws which are literally screwed into the sand, leaving an eye loop exposed. This is the point of attachment for the rope bridle. |
|  | Anti-chafing gear (heavy duty hose) protects the rope bridle at point of contact with the sand screw eye loop. We splice the rope bridle to the sand screw *in situ*. |

**Carl Meyer – Papahanaumokuakea Predator Tagging**



The finished installation, consisting of sand screw, rope bridle, VR2 receiver and subsurface floats.

We use the sand screw installation whenever possible. In hard-bottom areas we use chain around natural arches in lieu of sand screws (the other components are identical).

We service these installations every 6-12 months, at which time we completely replace all mooring components (anchors, rope bridles, floats), and download and re-battery the receivers.

We plan to maintain these installations for the duration of the acoustic monitoring research (at least 2 years). We will remove these installations on completion of the research. Removal is straightforward, takes less than 10 minutes per installation and leaves nothing behind.

**Carl Meyer – Papahanaumokuakea Predator Tagging**

## Appendix 3 Itemized list of gear and materials

Diving gear (will be transported in and out of Monument)

3 BCDs
3 Regulators
2 Weightbelts
6 Pairs of fins
8 Masks
4 Snorkels
2 Dive computers
2 Wetsuits
3 Dive knives
2 Surface floats and reels
2 Mesh bags

Fishing gear (will be transported in and out of Monument)

4 Handlines and lures
3 Ten hook shark lines
3 Bait knives
1 Chopping board
6 Large surface buoys
1 large hand net
Frozen bait (tuna heads)
4 pole spears

Telemetry equipment (will be deployed in Monument waters)

230 V16 acoustic transmitters (will be surgically implanted in predators)
4 acoustic receivers (will be deployed on seabed)
Mooring supplies for acoustic receivers (see Appendix 2)
3 triaxial accelerometer-camera dataloggers

Miscellaneous items (will be transported in and out of Monument)

2 Laptop computers
2 Computer-receiver interfaces
Various rope working tools (fids, tape, rope cutter)
Receiver servicing supplies (batteries, electrical tape, scrubbing brushes)

Appendix 4 – Carl Meyer – PMNM Predator Tracking

Accelerometer-digital camera datalogger package deployed on a tiger shark

Appendix 5 Carl Meyer – Details of tissue sample collections

| Common Name | Scientific Name | # & Size of specimens | Collection location |
|---|---|---|---|
| Galapagos shark | *Carcharhinus galapagensis* | 45 x 0.5cc muscle tissue | FFS, PHR |
| Sandbar shark | *Carcharhinus plumbeus* | 20 x 0.5cc muscle tissue | FFS |
| Grey reef shark | *Carcharhinus amblyrhincos* | 20 x 0.5cc muscle tissue | FFS |
| Blacktip shark | *Carcharhinus limbatus* | 20 x 0.5cc muscle tissue | FFS |
| Whitetip reef shark | *Triaenodon obesus* | 20 x 0.5cc muscle tissue | FFS |
| Ulua | *Caranx ignobilis* | 45 x 0.5cc muscle tissue | FFS, PHR |
| Omilu | *Caranx melampygus* | 20 x 0.5cc muscle tissue | FFS |
| Kahala | *Seriola dumerilii* | 20 x 0.5cc muscle tissue | FFS |
| Kawakawa | *Euthynnus affinis* | 20 x 0.5cc muscle tissue | FFS |
| Earle's Splitfin | *Luzonichthys earlei* | 20 x entire fish* | FFS |
| Thompson's Anthias | *Pseudanthias thompsoni* | 20 x entire fish* | FFS, PHR |
| Hawaiian Longfin Anthias | *Pseudanthias hawaiiensis* | 20 x entire fish* | FFS, PHR |
| Yellow Anthias | *Holanthias fuscipinnis* | 20 x entire fish* | FFS, PHR |
| Threespot Chromis | *Chromis verater* | 20 x entire fish* | FFS, PHR |
| Whitetailed Chromis | *Chromis leucura* | 20 x entire fish* | FFS |
| Moano | *Parupeneus multifasciatus* | 30 x entire fish* | FFS, PHR |
| Milletseed Butterflyfish | *Chaetodon miliaris* | 20 x entire fish* | FFS, PHR |
| Yellowfin Soldierfish | *Myripristis chryseres* | 20 x entire fish* | FFS, PHR |
| Yellow-threaded goatfish | *Parupeneus chrysonemus* | 10 x entire fish* | PHR |
| Lined Coris | *Coris ballieui* | 10 x entire fish* | PHR |
| Bluelined surgeonfish | *Acanthurus nigroris* | 20 x entire fish | FFS, PHR |
| Blacktail wrasse | *Thalassoma ballieui* | 20 x entire fish | FFS, PHR |
| Benthic algae[+] | *TBD*[+] | 800g | FFS, PHR |
| Plankton | *Various* | 800g | FFS, PHR |

* To reduce impact, we will sample individuals of only the 3 most abundant species present at the FFS & PHR mesophotic sites. We cannot predict with certainty what these species will be until we reach specific dive sites, hence we include this list of 11 species derived from previous surveys of mesophotic reef fauna.

[+]We will collect samples of the most abundant benthic algae at each site (200g per site, 800g total). The samples requested are based on estimated wet weight required to yield at least 5g of prepared, dried sample for isotopic analyses.

# Papahānaumokuākea Marine National Monument
# Compliance Information Sheet

**1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):**

Carl Meyer (Field PI, Research Diver), HIMB
James Anderson (Field Technician, Research Diver), HIMB
Melanie Hutchinson (Field Technician, Research Diver), HIMB
Yannis Papastamatiou (Field PI, Research Diver), HIMB
Christian Clark (Field Technician, Research Diver), HIMB
Melanie Hutchinson (Field Technician, Research Diver), HIMB
Randy Kosaki (Field Technician, Research Diver), NOAA
TBD (Field Technician), (Field Technician, Research Diver), HIMB

**2. Specific Site Location(s): (Attach copies of specific collection locations):**
Waters <300m depth in and around Monument locations;

(1) We will recover, download and redeploy up to 48 receivers deployed at the following locations;

| Atoll | Location Description | Latitude | Longitude | Depth (ft) |
|---|---|---|---|---|
| FFS | Rapture Reef | 23.63509 | -166.18570 | 85 |
| FFS | Gins | 23.72615 | -166.16967 | 37 |
| FFS | Big Gin Bay | 23.73355 | -166.16612 | 5 |
| FFS | Big Gin Point | 23.73542 | -166.16696 | 9 |
| FFS | SE of La Perouse | 23.74926 | -166.21773 | 70 |
| FFS | La Perouse | 23.76945 | -166.26208 | 30 |
| FFS | East Island | 23.78686 | -166.20709 | 10 |
| FFS | NE of La Perouse | 23.80545 | -166.26106 | 72 |
| FFS | Round & Mullet | 23.82747 | -166.22857 | 10 |
| FFS | Tern Island | 23.86664 | -166.28820 | 10 |
| FFS | Trig Island | 23.86945 | -166.24158 | 15 |
| FFS | Outside Trig | 23.86945 | -166.24158 | 15 |
| FFS | Trig Island | 23.87117 | -166.24220 | 4 |
| FFS | Trig Island | 23.87124 | -166.24323 | 4 |
| FFS | Trig Island | 23.87127 | -166.24102 | 3 |
| FFS | Trig Island | 23.87135 | -166.24435 | 3 |
| FFS | East Tern | 23.87135 | -166.28203 | 6 |
| FFS | Trig Island | 23.87194 | -166.24138 | 13 |
| FFS | Trig Island | 23.87200 | -166.24205 | 5 |
| FFS | Trig Island | 23.87205 | -166.24297 | 3 |



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| | | | | |
|---|---|---|---|---|
| FFS | Trig Island | 23.87206 | -166.24529 | 5 |
| FFS | Trig Island | 23.87220 | -166.24353 | 4 |
| FFS | Trig Island | 23.87237 | -166.24432 | 4 |
| FFS | Northern Barrier Reef | 23.88183 | -166.29223 | 147 |
| FFS | Northern Barrier Reef | 23.88183 | -166.29223 | 147 |
| FFS | North of Trig | 23.88609 | -166.22641 | 150 |
| Gardner | West Cove | 24.99834 | -167.99982 | 51 |
| Kure | SE Channel | 28.38183 | -178.30860 | 60 |
| Kure | West Channel East Side | 28.38897 | -178.36187 | 50 |
| Kure | West Channel | 28.40388 | -178.37508 | 70 |
| Kure | Eastern Barrier Reef | 28.42502 | -178.28172 | 80 |
| Kure | North Barrier Reef | 28.46045 | -178.32629 | 90 |
| Laysan | South End | 25.75463 | -171.71562 | 66 |
| Laysan | West Cove Channel | 25.77395 | -171.74248 | 30 |
| Lisianski | South Neva Shoals | 25.88237 | -173.91573 | 85 |
| Lisianski | East Side of Island | 26.05728 | -173.95957 | 14 |
| Maro | North Tip | 25.45842 | -170.67104 | 55 |
| Maro | Shark Point | 25.46057 | -170.68168 | 65 |
| Midway | Frigate Point | 28.19117 | -177.39450 | 30 |
| Midway | Fish Hole | 28.19742 | -177.36272 | 40 |
| Midway | North Barrier Reef | 28.28610 | -177.36212 | 90 |
| Nihoa | West Side | 23.05942 | -161.93058 | 40 |
| PHR | SW Corner | 27.75290 | -175.94805 | 50 |
| PHR | SE Channel | 27.78702 | -175.83623 | 30 |
| PHR | Main Channel -West Side | 27.79092 | -175.86300 | 35 |
| PHR | West Spur and Groove | 27.80215 | -176.01095 | 100 |
| PHR | NE Side | 27.90115 | -175.72205 | 65 |
| PHR | NW Side | 27.91095 | -175.90890 | 85 |

(2) We are also requesting 4 additional receiver deployments at FFS (2) and PHR (2) to extend our listening coverage at these atolls into deeper, mesophotic habitats. Exact locations of new deployments will be recorded using a handheld GPS. In addition we plan to swap out up to 8 Ecological Acoustic Recorder units (EARs) that are already co-located with several of our acoustic receivers. EARs have been deployed in the Monument by Dr. Marc lammers (HIMB/NOAA) in order to monitor biological (e.g. whale song) and manmade (boat engine noise) sounds.

(3) Fish capture and tagging will be carried out from ship-based skiffs and will occur in waters around Nihoa, Mokumanamana, French Frigate Shoals, Lisianski, Pearl & Hermes Reef, Midway and Kure. Exact fish tagging locations will be recorded using a handheld GPS.

(4) Reef fishes will be collected using pole spears in shallow waters and on mesophotic reefs (depth 150-300ft) at FFS and PHR. Exact fish collection locations will be recorded using a handheld GPS.

(5) Algal samples will be collected by hand from shallow and mesophotic reefs at FFS & PHR. Exact algal collection locations will be recorded using a handheld GPS.

(6) Plankton samples will be collected using towed plankton nets in the waters around FFS & PHR. Exact plankton sampling locations will be recorded using a handheld GPS.

**3. Other permits (list and attach documentation of all other related Federal or State permits):**

Not Applicable

**3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.**

Not Applicable

**4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):**

**Transport (ship):** NOAA is providing transportation for field personnel from Honolulu to locations within Papahānaumokuākea on NOAA ship Hiialakai.

**Accommodation:** NOAA is providing accommodation for field personnel from within Papahānaumokuākea on NOAA ship Hiialakai.

**Small boat for field ops:** NOAA is providing ship-based skiffs for field operations within Papahānaumokuākea.

**Fieldwork supplies:** Funds for telemetry and fishing supplies will be provided by HIMB under an MOA with NOAA, and by National Geographic.

**Laboratory supplies/stable isotope analyses:** Funds for SI analyses will be provided by National Geographic.

**5. Time frame:**
Activity start: 2011
Activity completion: 2013

The proposed activities are part of an ongoing effort to quantify top predator long-term movements and feeding habits in Papahānaumokuākea. Sharks and large predatory fishes will be equipped with multi-year life span transmitters. Transmitters deployed in the 2011 season will be viable until at least 2013.

Dates actively inside the Monument:
From: July 23, 2011
To: Sept 30, 2011

Cruise #1 – 23 July to 20 Aug (Tentative)
Cruise #2 – Sept 5-30

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application: Cruise dates need to be finalized.

Personnel schedule in the Monument:
Cruise itineraries TBD

**6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:**

**7. Check the appropriate box to indicate how personnel will enter the Monument:**

☒ Vessel
☐ Aircraft

Provide Vessel and Aircraft information:

NOAA ship Hiialakai

**8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):**

☐ Rodent free, Date: TBD
☐ Tender vessel, Date: TBD
☐ Ballast water, Date: TBD

☐ Gear/equipment, Date: TBD
☐ Hull inspection, Date: TBD

**9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):**
Vessel name:
Vessel owner:
Captain's name:
IMO#:
Vessel ID#:
Flag:
Vessel type:
Call sign:
Embarkation port:
Last port vessel will have been at prior to this embarkation:
Length:
Gross tonnage:
Total ballast water capacity volume (m3):
Total number of ballast water tanks on ship:
Total fuel capacity:
Total number of fuel tanks on ship:
Marine Sanitation Device:
Type:

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems:

Other fuel/hazardous materials to be carried on board and amounts:

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type:

VMS Email:
Inmarsat ID#:

**10. Tender information:**

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors:

NOAA ship Hiialakai carries up to 6 skiffs, 2 have inboard diesel engines, the remainder have 4-stroke outboard gasoline engines

## Additional Information for Land Based Operations

**11. Proposed movement of personnel, gear, materials, and, if applicable, samples:**

**12. Room and board requirements on island:**

**13. Work space needs:**

DID YOU INCLUDE THESE?

- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
**DIVISION OF AQUATIC RESOURCES**
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

June 9, 2011

TO: Division of Aquatic Resources File

THROUGH: William J. Aila, Jr., Chairperson

FROM: Francis Oishi
Division of Aquatic Resources

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO CARL MEYER, UNIVERSITY OF HAWAII, HAWAII INSTITUTE OF MARINE BIOLOGY, FOR ACCESS TO STATE WATERS TO CONDUCT TOP PREDATOR FEEDING HABITS AND MOVEMENT RESEARCH ACTIVITIES UNDER PERMIT PMNM-2011-018.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title:
Papahānaumokuākea Marine National Monument Research Permit to Carl Meyer, University of Hawaii, Hawaii Institute of Marine Biology, for Access to State Waters to Conduct Top Predator Feeding Habits and Movement Research Activities

Permit Number: PMNM-2011-018

Project Description:
The research permit application, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument (Monument), including the NWHI State waters from May 1, 2011 through October 31, 2011.

This project is to equip top predators (sharks and large fishes) with electronic tags, and monitor their movements using acoustic receivers (deployed on the sea floor) and satellites. In addition, this project proposes to determine feeding activities of top predators by collecting reference isotopic samples from abundant reef fishes, algae and phytoplankton in deep and shallow reefs. The purpose of the research is to provide Monument managers with information on the movement patterns and feeding habitats of culturally and ecologically important top predators in the Monument. This would include data on shark movement patterns and diet at French Frigate Shoals, which would lead to a better understanding of shark predation on Hawaiian monk seals

and selecting appropriate management and mitigation strategies. Activities include downloading and deploying underwater receivers, equipping top predators with transmitters and data loggers, collecting small tissue samples for chemical analysis, and collecting lethal samples of common food chain items (reef fish, algae and phytoplankton) for isotopic reference. Predator handling & tagging activities are carried out in accordance with the animal use protocols of the University of Hawaii (protocol #05-053). The entire handling process can be completed in less than 10 minutes.

The proposed activities are in direct support of the Monument Management Plan's priority management need 3.1 – Understanding and Interpreting the NWHI (through action plan 3.1.1 – Marine Conservation Science) and 3.2 – Conserving Wildlife and Habitats (through action plan 3.2.1 – Threatened and Endangered Species). These action plans call for further understanding of "shark abundance, prey preferences, and seasonal movement patterns." Activities to support threatened and endangered species, including shark tagging and tracking such as those to be carried out by the permittee, are also addressed in the Monument Management Plan Environmental Assessment (December 2008) which resulted in a FONSI. This EA summarizes that monitoring predation of sharks on monk seals could have a beneficial effect on the endangered Hawaiian monk seal by decreasing population loss. (PMNM MMP Vol. 2, p.173). Tagging and tracking activities, such as those proposed, would enhance knowledge of interactions between top predators and monk seals.

Consulted Parties:
The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). The Principal Investigator for this project, Carl Meyer, has also been consulted with respect to his experience in successfully tagging sharks and fishes. In addition, the permit application has been posted on the Monument Web site since March 10th, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Exemption Determination:
After reviewing HAR § 11-200-(8), including the criteria used to determine significance under HAR § 11-200-12, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit, including the tagging of the subject sharks and fishes, collection of tissue biopsies, and recovery and redeployment of underwater acoustic receivers, have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. Since this permit involves an activity that is precedent to a later planned activity, i.e. the future recovery of underwater acoustic receivers containing predator movement data, the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and section 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. exempts the class of actions which involve "basic data collection, research, experimental management, and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource." This exemption class has been interpreted to include tagging, monitoring and tracking animals in the field to record movement patterns, such as those being proposed. Additionally, Exemption Class #5, Exempt Item #3 includes "affixing transmitters, markers to wild animals to record movement longevity. Placing recording devices in the field to determine animal movement" as well as the "capture of aquatic animals, tagging of said animals and attempted recapture to determine migration patterns, growth and life cycles." DEPARTMENT OF LAND & NATURAL RESOURCES, EXEMPTION LIST FOR THE DIVISION OF FISH AND GAME 3-4 (January 19, 1976).

The proposed predator feeding and tagging study activities here appear to fall squarely under the exemption class identified under HAR § 11-200-8.A.5., and are succinctly described under the former Fish and Game Division exemption list published in 1976, as involving the capture and tagging of aquatic animals to determine movement patterns and the collection of aquatic animals to study migration patterns and life cycles. As discussed below, no significant disturbance to any environmental resource is anticipated in either the tagging of top predators, recovery of instrumentation deployed to monitor predator movements, or collection of potential prey items including reef fish, algae and phytoplankton. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if "the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment." HAR § 11-200-8.B. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

This study primarily involves 'catch and release' procedures which require only brief disturbance of top predators. Empirical data show tagged animals return to normal behavior patterns within a few hours of release. The receiver moorings used in this study leave no trace of their presence when removed. With this in mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. The project also involves collection of common reef fish, algae and phytoplankton. No significant impacts are anticipated as a result of the proposed collection techniques. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any

anticipated indirect or cumulative impacts, nor did it raise any cultural concerns, that would occur as a result of these activities.

The activities would be conducted from the NOAA Ship HI'IALAKAI (PMNM-2011-009) during its September cruise. The following table lists additional activities that are anticipated to take place on this cruise pending approval of permit applications.

**Table 1. Concurrent Projects Aboard NOAA SHIP HI'IALAKAI**

| Permit | Purpose and Scope | Location |
|---|---|---|
| PMNM-2011-009 NOAA Ship HI'IALAKAI | The permit allows NOAA Ship HI'IALAKAI entry into PMNM. Personnel aboard the vessel will be permitted under separate permits. | All locations |
| PMNM-2011-025 Bowen (proposed) | The proposed action is to allow collection of specific reef fish, invertebrate and algal species | All locations |
| PMNM-2011-019 Valenzuela (proposed) | The proposed action is to allow filming activities for use on public television stations | All locations |
| PMNM-2011-026 Rossiter (proposed) | The proposed action is to allow collection of live coral and fish. | All locations |
| PMNM-2011-038 Nakamoto (proposed) | The proposed action is to allow filming for Hawaii Skin Diver publications | All locations |
| PMNM-2011-42 Kosaki (proposed) | The proposed action is to allow collection of unidentifiable specimens located on deep reefs | All locations |
| PMNM-2011-24 Gleason (proposed) | The proposed action is to survey and monitor maritime heritage sites | All locations |

This is the only shark tagging study proposed. Three additional proposed activities include collections of fish and/or algal species, Rossiter's, Bowen's and Kosaki's proposed collections. Due to both the exploratory and baseline nature of this Applicant's proposed collections at depth, an exacting list of proposed collections is unavailable. Therefore there is the potential to overlap with Bowen's proposed collections of reef fishes at French Frigate Shoals and Pearl and Hermes Atoll on deep coral reefs. To mitigate this potential overlap and prevent duplicative sampling, species will be shared between both Bowen and Meyers. One shallow reef fish species (*Parupeneus multifasciatus*) is proposed to be collected by both Meyer and Bowen. Meyer and Bowen have requested to collect this species from different locals, so again no sampling overlap is present. Specifically, Meyer proposes collection reef fishes at Pearl and Hermes Atoll and French Frigate Shoals, whereas Bowen proposes collection of this species at Gardner Pinnacles,

Laysan Island, Lisianski Island and Maro Reef – thus no overlapping collections are proposed. Collections by Kosaki in mesophotic depths will not overlap with the Applicant's proposed fish, algal or phytoplankton collections as Kosaki is only requesting collection of unknown/unidentifiable species. Collections by Rossiter will not likely overlap as none of the listed species on Rossiter's application are likely to be the top three most common fishes as the Applicant is requesting.

The culmination of these permits, and their disparate activities, occurring throughout the Monument over a 4-week period, is not anticipated to have significant cumulative impacts. The NOAA Ship OSCAR ELTON SETTE (PMNM-2011-008) may also be in the Monument during this time frame facilitating needs of the monk seal camps under the management permit (PMNM-2011-001).

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant.

Again, any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures. The predator tagging and monitoring portion of this project has been subject to the public review process for several years, as the applicant was in fact permitted to conduct the same activities in previous years. These previous tagging activities have already provided important insights into top predator migrations in Monument waters, with minimal impact to Monument resources. Predator tagging requires only brief handling of the subject animals. This methodology remains the same as previous years. In addition, the predator handling & tagging activities would be carried out in accordance with the animal use protocols of the University of Hawaii (protocol #05-053). Underwater receivers are small and leave no trace of their presence after removal. The additional request for collection of common reef fish, algae and phytoplankton samples is a new addition for the Applicant but his proposed methods have been used extensively within State waters without adverse effects. The PI for this project (C. Meyer) is experienced in this activity and reports that adverse effects are minimal.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

William J. Aila, Jr.
Chairperson, Board of Land and Natural Resources

Date